Chapter 2. Master Responses to Frequent Comments

The final EIR provides information on the following areas to respond to multiple comments received on the draft EIR during the public comment period. To avoid redundant explanations in response to frequent comments, Chapter 3 refers the reader to relevant portions of this chapter in the responses to individual comments. When a comment resulted in a change to the draft EIR, the response refers to the location in the text of the draft EIR where the change is to be made. Added text is indicated with double underlining (additions) and deleted text is struck out (~~deletions~~).

The following issues are addressed in this chapter:

Master Response 1. Funding and Staffing Sources at RWQCBs

Master Response 2. Effects of the Proposed GO on Existing Land Application Programs and Sites

Master Response 3. Setbacks and Buffer Zones

Master Response 4. Regulation of Chromium, Molybdenum, Copper, and Lead

Master Response 5. Travel Limitations on Paved and Unpaved Roads (Mitigation Measures 10-1 and 10-2 from the Draft EIR)

Master Response 6. Monitoring of Fecal Coliform versus Salmonella

Master Response 7. Grazing Period Restrictions (Mitigation Measure 4-2 from the Draft EIR)

Master Response 8. Extension of Grazing Period Related to Public Health (Mitigation Measure 5-2 from the Draft EIR)

Master Response 9. Visible Airborne Particulate Matter

Master Response 10. Basis for Size Restrictions on Application Sites

Master Response 11. High/Low Potential for Public Exposure to Biosolids

Master Response 12. United States versus European Standards for Land Application of Biosolids

- # Master Response 13. Surface Water and Groundwater Quality Impact Conclusions
- # Master Response 14. Validity of Groundwater Quality Analyses Given the Controversy over the Part 503 Regulations
- # Master Response 15. Validity of the Groundwater Analysis Given the Depth to Groundwater Requirements
- # Master Response 16. Groundwater Quality Analysis and Preferential Flow Paths
- # Master Response 17. Setback Distances, Flooding, and Relationships to Water Quality Impact Analyses for Surface Water Resources
- # Master Response 18. Ohio Study

Master Response 1. Funding and Staffing Sources at RWQCBs

Several commenters voiced concern that there may be inadequate staffing or funding at the regional water quality control boards (RWQCBs) to oversee the proposed GO land application program and its various mitigation and monitoring requirements. Staffing is frequently an issue for new programs. Currently, annual fees received for issuing the proposed GO are specified in Section 2200, Article 1, Chapter 9 of Title 23 of the California Code of Regulations. Those annual fees are $1,200 for sites greater than 40 acres and $400 for sites less than 40 acres. Some sites will require more oversight, thus raising the oversight costs above that location's annual fee. The proposed GO is written to minimize complaints and unscheduled site inspections/investigations by requiring practices that prevent nuisances and afford environmental protection. Noncompliance may result in enforcement (including fines that include staff costs). The goal has been to minimize the need for constant oversight. Given the fee structure, the SWRCB does not anticipate that the proposed GO program will place an unworkable burden on RWQCB resources.

Master Response 2. Effects of the Proposed General Order on Existing Land Application Programs and Sites

All existing land application sites under the Superior Court Order will be required to comply with the proposed GO if it is adopted. The interim application of biosolids at these sites is a part of the existing conditions described on page 2-1 of the draft EIR. To comply, these permit holders will need to submit a new notice of intent and preapplication report to the RWQCB and go through the application process. If the operation is in compliance with provisions in the proposed GO, the RWQCB will be able to issue a notice of applicability to the project. If the project does not comply with the proposed GO, the applicant may need to pursue an individual waste discharge permit. The need to review other existing land application operations (not affected by the Superior Court Order)

will be determined by the RWQCB on a case-by-case basis, but the proposed GO is not intended to regulate every biosolids use site in California.

Master Response 3. Setbacks and Buffer Zones

Setbacks and buffer zones have been developed for the proposed GO on a "best professional judgment" basis. The setback and buffer requirements contained in existing regulations and guidance documents were reviewed before the proposed GO restrictions were set. The regulations and other sources reviewed included the California Department of Health Services' Drinking Water Source Assessment and Protection (DWSAP) Program, Final Review Draft (August 1998); Water Well Standards: State of California Bulletin 74-81; and existing regulations and standards from other states. The use of standards and practices that have been in place and have proven to be effective precludes the need for lengthy research projects to establish new setbacks or buffers for land application of biosolids.

Master Response 4. Regulation of Chromium, Molybdenum, Copper, and Lead

The proposed GO contains several metal limits that differ from those in the Part 503 regulations and identifies metals that currently are not regulated. This condition raised numerous questions about the proposed GO. Since the draft EIR was issued, one metal (chromium) has been removed from the regulation. Because no adverse effects have been observed from chromium in sludges, the regulation of chromium is being deleted from the proposed GO. In contrast, molybdenum, a pollutant that may cause adverse effects in ruminant animals, will remain in the proposed GO. Use of biosolids for growing animal feed and use on pastureland are two of the intended uses applicable for this proposed GO. Although removed from the Part 503 regulation by the court system for its conservative approach, the original risk-based limit for the molybdenum cumulative pollutant loading rate is the best scientific limit and has been incorporated into the proposed GO to protect animal health. The ceiling concentration is performance-based and derived from the National Sewage Sludge Survey. Background information on the Part 503 risk assessment is provided in Appendix B.

Other limits different from those included in the Part 503 regulations are the ceiling concentrations for lead (Pb) and copper (Cu). These limits are taken from the California Health and Safety Code, Section 25157.8, which states that any waste containing total lead in excess of 350 parts per million (ppm) or copper in excess of 2,500 ppm must be disposed of in a Class I hazardous waste landfill. Section 25157.8 contains an exclusion that requires that any such wastes be handled on an individual basis.

Refer to Appendix A of this final EIR for a list of metals to be regulated.

Master Response 5. Travel Limitations on Paved and Unpaved Roads (Mitigation Measures 10-1 and 10-2 from the Draft EIR)

Several changes have been made to the text of Chapter 10, "Air Quality", so that the text better reflects the programmatic nature of the biosolids EIR. In response to several comments, the last paragraph on the thresholds of significance for air quality on page 10-6 has been deleted and replaced with the following:

> Project-related emissions typically are considered significant if they exceed specific thresholds established by individual air districts. Those thresholds are generally for land use development projects that would result in permanent long-term emissions. In contrast, biosolids application at any one site would be short term because increased traffic volumes and associated air emissions would occur only during the brief period when the biosolids are delivered and applied. Even though traffic and air emissions for any single biosolids application project would be short-term, areawide emissions from several biosolids application projects have the potential to create significant air quality impacts.

In addition, the first impact and associated mitigation measures have been deleted and replaced with the following:

> **Impact: Significant Increase in ROG, NOx, and PM10 from Biosolids Transport Vehicles and Biosolids Spreaders**
>
> > Transporting biosolids from wastewater treatment plants to farms and spreading and mixing biosolids into the soil would generate vehicle emissions and fugitive dust from the use of heavy-duty transport vehicles and farm vehicles. Individually, such actions from a single biosolids project would occur on a short-term basis and would likely have less-than-significant air quality impacts. However, a large number of these actions occurring concurrently have the potential to generate substantial quantities of ozone precursors and PM10.
> >
> > Individual air districts classified as nonattainment areas for the state or federal ozone or federal PM10 ambient standards are required to prepare state implementation plans (SIPs) and air quality management plans (AQMPs) showing how they will come into compliance with the ambient standards. Those plans include emission budgets for vehicles and nonvehicular sources. Emissions from heavy-duty vehicles, including biosolid transport vehicles, are included within the emission budgets prepared as part of ozone and PM10 AQMPs. Emissions from farm activities, including off-road vehicle travel and wind-blown dust, are also included in the emission budgets of those plans (O'Bannon pers. comm.). Consequently, both on-road and off-road vehicular emissions associated with biosolids application projects are included in the

emission budgets in the applicable air quality plans. Because those plans describe the measures that would be used to attain the ambient standards, no additional mitigation measures are needed and the proposed project is considered to have less-than-significant air quality impacts from on- and off-road vehicle emissions.

Mitigation Measure: No mitigation is required.

Master Response 6. Monitoring of Fecal Coliform versus Salmonella

In developing the Part 503 regulations, the Natural Resources Council Committee of the National Academy of Sciences peer-reviewed the U.S. Environmental Protection Agency's (EPA's) risk assessment and methodologies. Afterward, it made the following recommendation: "Until a more sensitive method for the detection of salmonella is developed, the present test should be used for support documentation, but not be substituted for the fecal coliform test in evaluating sludge as class A." As such, the discharger is free to test for salmonella and use that information for support documentation, but those data will not be used to determine Class A biosolids. It is acknowledged that the EPA is working on a more sensitive test for salmonella. However, until a more sensitive test is developed, no test is sensitive enough to definitively determine class A biosolids. The proposed GO has been modified to exclude current testing methods for salmonella for Class A Part 503 compliance determinations but to allow for future EPA-approved methods of testing for salmonella.

Master Response 7. Grazing Period Restrictions (Mitigation Measure 4-2 from the Draft EIR)

Many commenters (mainly from municipal wastewater treatment plants and professional associations of sanitation districts) questioned Mitigation Measure 4-2 and the need to extend the grazing waiting period after biosolids application from the 30 days required by Part 503 regulations to the recommended 60-90 days. In the commenters' view, the Part 503 regulations were based on thorough scientific research. Given this, many commenters requested justification for this mitigation measure. Points made included the fact that synthetic organic compounds (SOCs) in biosolids typically are detected in very low concentrations or not at all because the sludge treatment process destroys them, as it does pathogens, such as viruses. The commenters felt that extension of the waiting period was unnecessary and potentially placed biosolids at an economic disadvantage compared to other mulches and soil amendments that might be used on pastureland and grazing land.

The mitigation measure was proposed because of continuing uncertainty over the occurrence and persistence in the soil environment of pathogens and SOCs associated with biosolids that could potentially affect the health of grazing animals and short-term land productivity. Animal health is a land productivity issue because unhealthy grazing animals may not gain weight as rapidly as desirable or may not produce as much milk; in cow-calf operations, offspring or the quality of the meat may be inferior or unacceptable. These conditions would reduce land productivity.

Many letters supported by references that included reprints of scientific reports came from commenters who were equally convinced that potentially dangerous and environmentally damaging levels of SOCs and disease pathogens are indeed present in biosolids, including "exceptional quality" (EQ) biosolids. After these and other readily accessible articles were reviewed, several were found to be sufficiently convincing to raise uncertainty and questions about the persistence of pathogens and SOCs and their potential impacts on grazing animal health.

Articles reviewed included the following:

Duarte-Davidson, R., and K. C. Jones. 1996. Screening the environmental fate of organic contaminants in sewage sludge applied to agricultural soils: The potential for transfers to plants and grazing animals. The Science of the Total Environment 185:59-70.

Alcock, R. E., A. Sweetman, and D. C. Jones. 1998. Assessment of organic fate in wastewater treatment plants, selected compounds and physicochemical properties. Chemosphere 38(10):2247-2262.

Because of continuing uncertainty and controversy among members of the scientific community regarding this issue, the SWRCB staff recommends a conservative approach that results in an extended grazing waiting period. This extension allows for natural soil bioremediation of any SOCs and disease pathogens that are incorporated into the soil with biosolids. The 30-day grazing waiting period was reviewed by the National Academy of Sciences (1996); it recommended that additional research be conducted.

Several commenters pointed out that the EPA, when it released the Part 503 regulations, termed them as "works in progress" that would be updated as additional research is conducted. Several other commenters noted that the regulations were minimum standards (as most EPA regulations are) designed to be tailored to each state's individual needs. One commenter contrasted EPA's approach to biosolids regulation with its more conservative approach to pesticide regulation, where in the face of uncertainty and unknown scientific information, a conservative approach is warranted and the burden of proof rests with the regulated industry to demonstrate environmental safety. The SWRCB is considering a similar conservative approach with Mitigation Measure 4-2 in extending the grazing waiting period until additional research is completed.

One of the objectives of the proposed GO is to streamline the technical and environmental review and approval process for land application of biosolids for those sites and kinds of biosolids and management approaches that do not have significant issues requiring more in-depth evaluation and public comment. Because of this desire for streamlining, the proposed GO process must, by necessity, be conservative. In fact, in releasing the Part 503 regulations, the EPA encouraged and assumed that state and local agencies will address additional site-specific issues.

One of the mitigation measures included in the draft EIR is screening of soils and site conditions to eliminate problematic situations that require more in-depth technical information and analysis from being permitted under the proposed GO. Along with being conservative, there may

be certain site-specific conditions under which the proposed GO's conditions and mitigation measures may not be necessary.

An individual seeking waste discharge requirements from an RWQCB has the choice of submitting an individual permit application for biosolids land application for those sites and biosolid compositions where the applicant does not believe the proposed GO and these recommended additional mitigation measures should apply. One example may be where the applicant believes "very clean" biosolids could be applied directly to pasture grass, and not incorporated into the soil, allowing grazing to be initiated after 30 days. The RWQCB could, on an individual project basis, confirm the quality of the material, based on land uses in the wastewater treatment service area or additional testing of the biosolids, and then, after technical review, approve such an application plan under an individual waste discharge requirement.

Also see Response to Comment 1-3 on the issue of detection of SOCs in biosolids and Response to Comment 16-13 on competitive disadvantages of waiting.

Master Response 8. Extension of Grazing Period Related to Public Health (Mitigation Measure 5-2 from the Draft EIR)

Numerous comments were received regarding the scientific justification for Mitigation Measure 5-2 (on page 5-29 of the draft EIR). This measure would extend the mandatory waiting period between the time biosolids are applied to grazing land and when animals can be allowed back on the land. The EPA Part 503 regulations and the proposed GO each require a 30-day waiting period. Mitigation Measure 5-2 would extend the period to 60 or 90 days, depending on average temperatures at the application site. Commenters felt that there is not adequate scientific justification for extending the waiting period beyond that required by EPA.

The mitigation measure has been proposed because of ongoing uncertainty and differences of opinion in the scientific literature regarding the occurrence and persistence of pathogens and SOCs in lands receiving biosolids (see also Master Response 7). There is a related concern regarding disease transmission via grazing animals.

When analyzing the public health risks associated with grazing animals, the main exposure pathway of concern is via the food chain (grazing animal ingestion of soil material and pathogens, and hence human ingestion of contaminated, undercooked meat). This exposure route is complex and the likelihood of exposure varies greatly with the pathogen.

Key factors are management of the site to prevent exposure and the ability of the particular pathogen to survive outside of the host. The longest-lived pathogens have typically been helminths such as *Ascaris* and *Taenia,* which have been found viable in biosolids-amended fields for up to many months and even years (Feachem et al. 1980). There is little evidence of actual transfer of such parasites from sludge to animals (Eastern Research Group 1992), but research conducted in Europe makes it clear that the pathway potential cannot be totally discounted (Isole et al. 1991). In the

United States, the only documented cases of transfer of tapeworms from sludge to animals to humans involved the surface application of large quantities of untreated sludge to a cattle grazing area of a prison farm in Virginia (Hammerberg et al. 1978, see Appendix E).

Appendix E in the draft EIR discusses the helminths of concern and their known or suspected presence in biosolids. Tapeworm (*Taenia* spp.) are primarily a hazard to livestock (beef and hogs) if the eggs are ingested from biosolids-amended fields that have not been properly managed (biosolids not tilled in and insufficient time allowed for die-off of any viable eggs). Ingestion of the eggs (from the soils/biosolids mixture at the surface) and the hatching of larvae and formation of cystercerci can damage the animal's organs. Humans can ingest the cysts from poorly cooked meat and develop the tapeworms.

Of the helminths, ova of *Ascaris* sp. (the human roundworm) survive up to 7 years under favorable environmental conditions (U.S. Environmental Protection Agency 1985). Work on the concentrations of Ascaris ova in sludges showed that this species had the highest concentration of all the helminths, with up to 10 ova per gram of sludge (Reimers et al. 1981).

Data on the presence and viability of helminth ova in digested sludges are shown below:

Helminth Egg Density in Treated Municipal Sludge

	Southern States[1]		Chicago[2]	
Helminth	Mean Ova/g dry weight	Viability	Mean Ova/g dry weight	Viability
Ascaris spp.	9.6	69%	2.03	`64%
Trichuris spp.	3.3	48-64%	0.360	20%
Toxocara spp.	0.7	52%	1.73	53%
Toxascarsi leonina	–	–	0.48	63%

[1] Source: Reimers et al. 1981.
[2] Source: Arthur et al. 1981.

The size of protozoa and helminth eggs make them less likely to find their way into aerosols or groundwater at land application sites (Kowal 1985). The concern is for surface contact and possible ingestion if the biosolids are not incorporated into the soil.

The National Research Council's (NRC's) review entitled "Use of Reclaimed Water and Sludge in Food Crop Production" recommended that "EPA should re-evaluate the adequacy of the

30-day waiting period following the application of Class B sludge to pastures used for grazing animals." This recommendation is based largely on concern about beef and pork tapeworm, whose ova have a greater potential to remain viable when applied to fodder or grazing land. According to Feachem et al. (1983) and the EPA model (SANDIA), 30 days should be sufficient time to destroy these ova. However, the NRC cites a single study done in Denmark (Isole et al. 1991) that showed that a small portion of the ova remained viable for 5-6 months. They were nonviable after 8-10 months of soil exposure.

In considerations of such data, climatic conditions are important. In a drier climate, such as California's, dessication and death of potential pathogens will occur more quickly and at a much higher rate. However, NRC noted that in this country, we depend on consumer cooking of meat to destroy any helminth cysts. Managing land application of biosolids and meat inspections provide additional controls. NRC further notes, "Generally, the fewer viable eggs of Taenia species allowed on grazing land, the better; however, the actual risk of a too short waiting period may not be measurable." The draft EIR with Mitigation Measure 5-2 recommends extending the 30-day period to 60 or 90 days as a precaution until better scientific evidence is available to indicate that the risk is minimal from the potential exposure.

Based on the information presented above and in Master Response 8, and the ongoing controversy over the fate of pathogens and SOCs in soils receiving biosolids, Mitigation Measure 5-2 has been left unmodified.

Master Response 9. Visible Airborne Particulate Matter

Many comments were received regarding the need for a wind speed restriction in the proposed GO. It is acknowledged that all dust from land application sites is not biosolids, the prohibition stated in the proposed GO is qualitative and that specifying a moisture content and a maximum-allowed wind gust threshold is an alternative means of addressing the same issue. This issue was given considerable thought. Ultimately, the proposed GO has been changed to modify the requirement to be less qualitative. The proposed GO now specifies that all biosolids sites must use material that is greater than 50% moisture content. For sites where tilling is proposed, biosolids must be incorporated within 24 hours in arid areas and within 48 hours in other climate zones. Also, a requirement to cover biosolids stored in the field for more than 24 hours has been added to control windblown material. By requiring a minimum moisture content, covering, and incorporation in an expedient manner, the potential for biosolids movement offsite will be reduced. A wind gust threshold was deemed inappropriate because of the difficulty of calibrated measurement applications statewide and the site-specific nature of wind events.

The text of the proposed GO, as found in Prohibition No. 14 of Appendix A, is changed to read as follows:

~~Any visible airborne particulate leaving the application site during biosolids applications or during incorporation of biosolids at the permitted site~~ The application of biosolids containing a moisture content of less than 50% is prohibited.

Also, the following text is added to the proposed GO, as found in Discharge Specification No. 6 of Appendix A:

If biosolids are applied to sites where the field will be tilled, biosolids shall be incorporated within 24 hours after application in arid areas and within 48 hours in nonarid areas. Tillage practices shall be used that minimize the erosion of soils from the application site by wind, stormwater, or irrigation water.

The text of the proposed GO, as found in Biosolids Storage and Transportation Specifications No. 6 of Appendix A, is modified as follows:

Biosolids ~~storage facilities that contain biosolids between October 1 and April 30 shall be covered during periods of runoff-inducing precipitation~~ placed onsite for more than 24 hours shall be covered.

The text for page ES-9, bullet 10 of the draft EIR is revised as follows:

~~application or incorporation into the soil is permitted when wind may reasonably be expected to cause airborne particulate to drift from the site~~ no application of biosolids containing a moisture content of less than 50%;

Master Response 10. Basis for Size Restrictions on Application Sites

Several commenters asked why the SWRCB had established 2,000 acres as the maximum size or operation to be permitted under one GO permit. Two thousand acres is a large operation, occupying more than 3 square miles. This size restriction, taken from the original Central Valley GO, was based on the average size of large-scale land application sites in the Central Valley. It was deemed undesirable to permit larger operations under a single permit because of the likely change in site conditions across such an expansive area.

Master Response 11. High/Low Potential for Public Exposure to Biosolids

Several commenters requested that the proposed GO contain an expanded definition of "high potential for public exposure". The text of the proposed GO in Finding No. 3(q.) of Appendix A is revised as follows:

> High Potential for Public Exposure Areas: Land located within one-half mile of ~~a developed border of a populated area~~. educational facilities, facilities designated for recreation activities other than hunting, fishing, or wildlife conservation, places of public assembly, hospital, or similar sensitive receptors.

Because the definition for "high potential for public exposure" has been revised, the definition for "low potential for public exposure" in the proposed GO is revised as follows:

> Low Potential for Public Exposure Areas: Land not ~~located within one-half mile of a developed border of a populated area~~ meeting the definition of high potential for public exposure areas.

Because of the modification to the definition of "high potential for public exposure" in the proposed GO, page 6-7 of the draft EIR, first impact and Mitigation Measure 6-1, are revised as follows:

> **Impact: Application of Class B Biosolids at Locations That May Conflict with Existing Land Uses in Urban Area; Recreation Areas; or Other Sensitive Areas, Including Schools, Hospitals, and Recreation/Public Assembly Areas**
>
> The proposed GO contains specifications, exclusions, and prohibitions designed to minimize conflicts with land uses adjacent to application sites. For example, it specifies areas of the state identified as "unique and valuable public resources" that are not regulated by the proposed GO and for which site-specific permits would be required; it requires compliance with the provisions of Part 503 regulations regarding the land application of biosolids that meet provisions for vector reduction; ~~it prohibits the dissemination from biosolids application sites of visible airborne biosolids particles~~, it stipulates the use of tillage procedures that minimize wind erosion; and it prohibits application within 500 feet of residential buildings. ~~However, the GO does not include setbacks from facilities for recreation activities; places of public assembly; hospitals; or other sensitive receptors that could be included under the definition of "populated areas" provided under "High Potential for Public Exposure Areas" in the definition section of the GO.~~ Although the proposed GO identifies the types of land uses where the high potential for public exposure could occur, it does not prohibit the use of biosolids adjacent to these areas. (The application of Class A biosolids would not conflict with these potential adjacent land uses because Class A biosolids have been treated to meet more stringent pathogen reduction standards than Class B biosolids.) The application of Class B biosolids near these sensitive

receptors could conflict with the land use (activities could be disturbed as a result of increased noise or traffic). This impact is considered potentially significant. To reduce this impact to a less-than-significant level, the SWRCB shall implement Mitigation Measure 6-1.

~~**Mitigation Measure 6-1. Require setbacks from areas defined as having a high potential for public exposure**. The GO will be modified to state that:~~

~~(a) no application of Class B biosolids shall be permitted within an area defined in the GO as having a high potential for public exposure unless the biosolids are injected into the soil and~~

~~(b) educational facilities; facilities designed for recreation activities other than hunting, fishing, or wildlife conservation; places of public assembly; hospitals; or similar sensitive receptors shall be included in the definition of "populated area" as used in conjunction with the designation "High Potential for Public Exposure Areas."~~

Mitigation Measure 6-1. Require injection of biosolids in areas defined as having a high potential for public exposure for Class B biosolids. The proposed GO will be modified to state that no application of Class B biosolids shall be permitted within an area defined in the proposed GO as having a high potential for public exposure unless the biosolids are injected into the soil.

Master Response 12. United States versus European Standards for Land Application of Biosolids

Several commenters were concerned that the SWRCB was using the federal Part 503 regulation as a starting point for its proposed GO regulating land application of biosolids, when most European countries have adopted controls that are much more restrictive. Canada and much of Europe have limits on the levels of heavy metals that can be applied to land that are, in most instances, lower than those proposed in the GO. In some instances, they are considerably lower. The differences are generally attributed to the method used to establish the limits.

The EPA developed its cumulative limitations based on an assessment of the various pathways for metals transfer from biosolids to soils and thence to humans or animals, with the goal of protecting humans, plants, and animal health. This approach allows for a gradual buildup of metals in the soil up to a point where an unacceptable health risk would occur. European and Canadian standards have been established using a variety of other standards and goals. For some, a policy of no accumulation or no net increase in background levels of metals in the soils was used to guide creation of limits. Because the natural attenuation of metals in soils is extremely slow, allowable amounts of intentional additions from biosolids are extremely small. Other countries have based their metals limits on the results of field studies or actual land application operations where an adverse effect on humans, plants, animals or soil microorganisms was observed. Limits have

been established below those concentrations where effects were observed after allowing for a variable safety margin (McGrath et al. 1994).

The scientific basis for the above approaches has been questioned in the technical literature surrounding land application of biosolids. There appears to be no stronger scientific basis for the European and Canadian standards than there is for the standards contained in the United States' Part 503 regulations; there is primarily a difference in the choice of target organisms for the health risk analysis and willingness to accept some health risk to support the reuse of treated sewage sludge. SWRCB staff has taken the Part 503 metals limitations, which are designed to protect human, plant, and animal health, and increased restrictions on metals application by requiring that soil background metals concentrations be included in the calculation of cumulative limits. Federal (EPA) and state (SWRCB-proposed GO) regulations also allow for modification as ongoing research into the effects of biosolids land application continues to better define the health risks and the effects on soil sustainability.

Master Response 13. Surface Water and Groundwater Quality Impact Conclusions

Several comments were received that generally questioned and recommended changes to the conclusions reached in the EIR regarding the CEQA level of significance for surface water and groundwater quality impacts. The analysis of water quality impacts that could occur from implementing the proposed GO, and the identification of their significance determination according to CEQA guidelines, was based partially on the comparative analysis conducted for development of the federal Part 503 regulation. Conservative assumptions of biosolids land application rates, duration of land application, contaminant concentrations, and environmental thresholds formed the basis of Part 503's rule development process.

Based on each chemical contaminant's fate and transport characteristics in the soil and aquatic environment, the risk of contamination through either the surface water or the groundwater pathway was evaluated in the Part 503 risk assessments and determined not to be limiting for any contaminant. Fourteen environmental pathways were evaluated for the Part 503 regulations. The concentrations of the regulated trace metals in biosolids deemed protective under these conservative fate and transport assumptions were limited by environmental pathways. These pathways involved long-term application of biosolids, and direct ingestion of biosolids by children, human consumption of food grown in biosolids, plant phytotoxicity, or animal toxicity.

Risk assessments were also performed for a wide variety of SOCs. However, based on the extremely low probability of occurrence and minimal concentrations of SOCs in biosolids samples from around the country, EPA determined that regulations for SOCs in the final Part 503 regulations were unnecessary.

The proposed GO includes several prohibitions and restrictions that are more conservative than the federal Part 503 regulations:

- # Land application of mixed wastes composed of EQ biosolids are regulated under the proposed GO; Part 503 risk assessments found that EQ biosolids do not pose an environmental risk and therefore are not regulated under the federal rules.

- # Land application is limited by setback distances from selected water resources such as wells and water bodies, runoff restrictions and slope. The risk assessments and resulting concentration limits for Part 503 regulations are based on assumptions that application occurs continuously on lands directly adjacent to water resources.

- # Land application is prohibited on steep slopes unless a certified erosion control plan is implemented.

- # Monitoring is required if groundwater is within 25 feet of ground surface. The Part 503 regulations determined that no monitoring of groundwater was necessary to ensure protection of groundwater resources.

- # The cumulative limitations for heavy metals coming from biosolids are more conservative than under the Part 503 regulations.

A comprehensive preapplication report must be submitted that includes requirements for background soils testing of metals and testing of selected organic compounds in the biosolids that will be applied.

The conservative assumptions and extensive risk assessments performed for development of the Part 503 regulations, combined with the additional conservative provisions, policies, and procedures contained in the proposed GO, provide a comprehensive basis for evaluating potential environmental impacts to surface water and groundwater resources for the EIR and determining that those impacts would be less than significant. Implementation policies and procedures under the proposed GO provide adequate flexibility for RWQCB staff to issue notices of application, with any additional allowable permit or enforcement conditions deemed necessary for protection of site-specific resources, for each notice of intent and preapplication report for land application. The general provisions, prohibitions, restrictions and minimum standards for land application under the proposed GO would be protective of water quality and consistent with RWQCB basin plans, state and federal water quality standards, and provisions of the state water code.

The proposed GO would be applicable for 15 years, after which it would be evaluated for necessary changes. In contrast, the risk assessments conducted for the Part 503 regulations were based on application of biosolids occurring continuously for 20 years, with exposed individuals obtaining all their drinking water from an affected well for 70 years. Therefore, biosolids application under the proposed GO has a low probability of exceeding threshold assumptions used for risk assessments in the Part 503 regulation development process.

The proposed GO requires RWQCB staff to ensure that application projects conducted under the proposed GO do not cause or contribute to any violation of water quality standards. Therefore, the potential impacts were considered less than significant, given that RWQCB staff are trained to identify potential water quality contamination processes and have available knowledge of the resources in their jurisdiction. They would use professional judgment for each application to land-apply biosolids to ensure that the proposed practices and site conditions protect the local water resources.

Master Response 14. Validity of Groundwater Quality Analyses Given the Controversy over the Part 503 Regulations

Several commenters questioned the validity of the analysis of potential groundwater quality impacts in the EIR, given that there is some controversy over assumptions used for the Part 503 regulations regarding the fate and transport processes of regulated contaminants and other contaminants that were not addressed under Part 503 regulations. With respect to different chemicals typically present in treated biosolids and geohydrologic conditions in California, the analysis of potential groundwater quality impacts for the EIR were primarily based on the risk assessments prepared for the Part 503 regulation development process (as described in Master Response 13) and the level of protection afforded by the proposed GO for the fate and transport of nitrate nitrogen.

Nitrates were used as a key indicator of potential groundwater quality impacts that could occur under the proposed GO because nitrates are readily soluble in water, they are readily present in biosolids or are rapidly produced from conversion of ammonia, and their transport is relatively unimpeded after water has infiltrated beyond the root zone where plant uptake can occur. Nitrate that infiltrates beyond the root zone is relatively unaffected by physical adsorption, structural modification, or decay processes. Other regulated and nonregulated chemical and biological contaminants have fate and transport characteristics governed by numerous factors. These generally restrict or impede transport in soil to some degree, including photodegradation; oxidation and reduction; solubility in water; affinity for organic matter, clay particles, and inorganic complexes; death and decay rates; biological uptake, absorption or degradation; and other physical/chemical degradation processes. The fate and transport of trace metals, SOCs and biological constituents are generally impeded to some extent by these various processes. Although some constituents may have transport characteristics similar to nitrate, there are no other chemical constituents with greater transport rates in the soil-water column than nitrate and other similar inorganic ions, such as chloride, that are conservative of their mass in the aquatic environment.

In addition, analysis of the potential effects of proposed GO implementation on groundwater quality based on nitrate is considered a conservative approach. It is regulated with state and federal primary drinking standards; California also has applicable numerical water quality objectives for nitrate in groundwater used for municipal supplies. Nitrate is relatively unaffected by typical drinking water treatment plant processes, such as coagulation and filtration; therefore, standards must protect the source water because nitrate cannot easily be removed. Other inorganic constituents with

similar properties, including chloride, salinity and total dissolved solids, are regulated by certain RWQCBs and EPA, with less stringent water quality objectives or secondary drinking water standards. For many trace metals and SOCs, either there are no established state groundwater quality objectives, or regulation of these constituents is through state and federal drinking water standards, for which compliance is required after water has passed through treatment processes. Many contaminants are readily removed as water infiltrates from the soil surface down to the groundwater or are downgraded to less harmful compounds through various physical, chemical, and biological processes.

Consequently, nitrate fate and transport were considered limiting factors for the analysis of potential impacts and protection of groundwater from contaminants in biosolids that could be land-applied under the proposed GO. The impact analysis therefore presumes that if a complete biosolids application program, pursuant to conditions of the proposed GO and in compliance with appropriate mitigation measures, would reduce transport of the highly mobile nitrate contaminants, then there would be very low probability of contamination from other less-mobile contaminants. The primary measure in the proposed GO that ensures minimal risks to groundwater impairment requires land application to not exceed the agronomic rate of nitrogen uptake. If nitrate is not allowed to infiltrate past the root zone at concentrations that would impair groundwater quality, then there would be low risk from transport of other contaminants. The proposed GO provides RWQCB staff with the regulatory provisions and scientifically based assurances that groundwater impairment from other less-mobile contaminants would not occur. In addition, if RWQCB staff determines that a biosolids application project could contribute to an area of existing regional groundwater nitrate contamination, the project can be required to modify application practices to further reduce the potential contributions to those existing problems or issue a site-specific WDR to address a unique site.

Master Response 15. Validity of the Groundwater Analysis Given the Depth-to-Groundwater Requirements

Comments were received that questioned the validity of impact analyses for groundwater quality, given that no minimum depth to groundwater is specified in the proposed GO for land application areas, recommended minimum depths to groundwater where biosolids application should not be allowed, or both. The risk assessments conducted for the Part 503 regulations were extremely conservative with respect to the distance of application of biosolids from groundwater resources on a horizontal and vertical basis. Potential transport of contaminants via the groundwater pathway were based on depth to groundwater of 1 meter (3.2 feet) and no lateral separation (human drinking water from a well located directly within the area of biosolids application). In practice, the prohibition of application to saturated lands and normal agricultural practices would preclude application to lands that have groundwater tables within the 1 meter zone because landowners would not typically grow crops in soils where the root zone is saturated. In addition, as described in Master Response 14, nitrate is a readily soluble compound within biosolids (or formed from ammonia in biosolids) that can infiltrate to groundwater unimpeded by soil interactions. There would be very low probability of groundwater impairment from trace metals and SOCs in biosolids that are

considerably less mobile if nitrate is not land applied at levels that would become detrimental in groundwater.

The proposed GO requires monitoring to be performed on areas that do have high groundwater levels (less than 25 feet from ground). Groundwater monitoring was not considered adequate mitigation for potential groundwater quality impacts because it would not sufficiently reduce, avoid or minimize the impacts under the State CEQA Guidelines. However, water quality monitoring is a particularly useful tool for the RWQCB staff that is responsible for implementing the biosolids permitting programs under the proposed GO because it will allow identification and tracking of whether land application in those areas is causing water quality impairment. Nitrate is therefore a good indicator for monitoring biosolids application sites because it is highly mobile compared to other regulated and nonregulated trace metals, pathogens, and SOCs. An RWQCB executive officer can impose more restrictive water quality monitoring requirements on applicators as well. If water quality impairment occurred and was detected, the RWQCB could enforce cleanup and abatement orders under provisions of the state water code. Consequently, SWRCB staff considers the impact analysis and CEQA significance conclusions justifiable given the very conservative conditions imposed upon land application projects that would be conducted under the proposed GO.

Concerns about migration of microbes into groundwater have also been considered in the EIR analysis. EPA is considering the need for microbial monitoring as part of its upcoming groundwater rule. When EPA issues its final rule, the SWRCB will review it and determine whether microbial monitoring requirements should be added to the GO.

Master Response 16. Groundwater Quality Analysis and Preferential Flow Paths

Some commenters are concerned that groundwater impacts may be underestimated, given that several research studies indicate that large pores in soil created by worms, roots, other burrowing animals, or physical processes may create preferential flow paths for infiltrating water and soluble contaminants. SWRCB staff does not disagree with the premise that preferential flow paths may facilitate or increase contaminant transport rates to groundwater. However, as described in Master Response 15, the Part 503 risk assessments for the groundwater pathway were based on an extremely conservative depth to groundwater assumption of 1 meter in sandy soils. The presence of macropores would not substantially affect the groundwater depth impact assessment; with respect to depth the increased transport of constituents in macropores would have a relatively small effect on groundwater quality given that the very shallow groundwater conditions were evaluated for the Part 503 regulations.

In addition, Master Response 14 describes the relationship between fate and transport of soluble nitrate to less-soluble contaminants, and the effect that relationship has on the evaluation of potential groundwater quality impacts. Because all contaminants would be subject to the same preferential flow paths as for nitrate over the distance of 1 meter, the potential groundwater quality

impacts from contamination with different chemicals would not be expected to be any greater than for nitrate.

Master Response 17. Setback Distances, Flooding, and Relationships to Water Quality Impact Analyses for Surface Water Resources

Several commenters questioned the level of protection afforded surface water resources by setback distances required in the proposed GO. Master Response 13 describes some of the major assumptions for the impact analysis in the EIR. With respect to biosolids application that occurs within certain setback distances, potential surface water quality impacts were primarily evaluated based on the existing evidence from the Part 503 risk assessments and rule development process and on the site-specific information and protective measures that RWQCB staff would have at its disposal to ensure that an application project complies with waste discharge requirements. In particular, under the proposed GO, each notice of intent and preapplication report would be reviewed by RWQCB staff members who are trained in the implementation of waste discharge permitting procedures, have access to site-specific information, and have discretionary authority to determine whether the project would be protective under and consistent with state water quality standards and provisions of the water code.

Nothing in the proposed GO would preclude RWQCB staff members from requiring individual waste discharge requirements (WDRs) if they determine that there would be an unacceptable risk to water quality. The setback distances, requirements for erosion control plans on steep slopes, and other general provisions of the proposed GO are consistent with typical best management practices (BMPs) required for WDRs approved for other similar waste discharges. Therefore, SWRCB staff considers the evaluation methods and assumptions for potential surface water quality impacts appropriate and CEQA significance conclusions justified.

With respect to biosolids application in areas subject to flooding, potential water quality impacts were considered minimal because the proposed GO prohibits land application of biosolids in areas subject to erosive events. This condition will prohibit land application of biosolids in stream floodways and lands adjacent to streams subject to erosive floodflows or causing gully erosion. SWRCB staff is confident that RWQCB staff members have the necessary skills and resources to identify areas susceptible to erosive forces; placement of biosolids in these areas would be avoided through review of the preapplication report information required under the proposed GO. Areas subject to erosive forces can be distinguished using information such as the location of defined streambanks and terraces and mapped information required in the preapplication report.

Recommendations in comment letters to increase the restricted area for biosolids application beyond the designated 100-year floodplain are not considered necessary by SWRCB to ensure water quality protection. The Federal Emergency Management Agency determines and maps the 100-year floodplains. Floodplain areas between the main floodway channel and outer floodplain boundary are subject to varying probabilities of being exposed to flooding. The outer fringes of defined floodplains in the generally level Central Valley or near larger rivers typically are subject to

inundation or erosion events infrequently. Areas outside of 100-year floodplains have a statistical probability of flooding that is less than once every 100 years; these are considered extremely unlikely events. Floodwaters on floodplains of larger rivers in flat valleys such as the Central Valley are often shallow and have low flow velocities; biosolids that may be applied in such areas would have a low probability of washing off of the site. Determining a setback restriction based solely on a statistically defined floodplain would be arbitrary. When used to determine whether there is a significant risk that biosolids would be carried from a specific land application, site floodplain mapping should be evaluated in concert with local topography, distance from active stream channels, and physical evidence of erosive floodflows. Isolated and infrequent inundation of biosolids application sites, provided they are not areas of gully erosion and washout, would not pose a significant threat to water quality.

Master Response 18. Ohio Study

Two commenters noted that information cited in the draft EIR from a study by Dorn et al. (1985) was not accurately portrayed. The Dorn et al. report, also referred to as the Ohio farm study and the Ohio health study, presented epidemiological results of a comparative study of farms in Ohio. Some of the farms were using biosolids for crop fertilization; others were using conventional fertilizers for a source of plant nutrients.

The concerns raised about the use of the Ohio farm study are noted, and it is agreed that the information from the study could have been presented more clearly. The mathematical calculations made in converting metric tons per hectare to wet tons per acre were made incorrectly and are revised. The precautionary notes on the use of these data to predict health risks are noted. The text on draft EIR page 5-26, paragraph four, and page 5-27, first paragraph, are amended as follows to address the concerns expressed:

> Incidental human contact and farmworker and family contact with biosolids were evaluated in an extensive study reported by Dorn et al. (1985). The 3-year study covered three geographical areas in Ohio and included 47 farms (164 persons in 78 families were evaluated) receiving annual applications of treated sludge (average of 2-10 dry metric tons/hectare/year; average of ~~20-90~~ 3.6-17.8 wet tons per acre per year at 25% solids) (Dorn et al. 1985). The illness rates in the families at their farms were compared with 46 control farms (130 persons from 53 families), all of whom initially participated by cooperating with monthly questionnaires concerning their health and their animals' health, annual tuberculin testing, and quarterly blood sampling for serological testing. It should be noted that the number of participating farms dropped as the study went on, and only 27% of the 93 original farms completed participation in the 3-year study.

A summary of the two study groups and their numbers over the years is shown below:

Unit	Study Group	Number Started	Number Participating		
			1 Year	2 Years	3 Years
Farms	Sludge	47	47	36	13
	control	46	46	37	13
Participants	Sludge	165	165	126	53
	control	130	130	109	37

Source: Comment letter 43, page 17 as cited from Dorn et al. 1985.

The study found that the estimated risks of respiratory illness, digestive illness, or general symptoms were not significantly different between sludge farm and control farm residents (Dorn et al. 1985). It also found no observed differences between disease occurrence in domestic animals on sludge and on control farms. The frequency of serological conversions (fourfold or greater rise in antibody) to a series of 23 test viruses and the frequency of associated illnesses were similar among persons on sludge and control farms. The absence of observed human or animal health effects resulting from sludge application in this study of Ohio farms should be considered with the knowledge that relatively low sludge application rates were used on these farms; the rates ~~are consistent with~~ were lower than typical application rates for agricultural uses in California (which may be as high as 30-40 wet tons per acre per year). Necropsy data and analyses of tissues found significant cadmium and lead accumulations in the kidneys of calves grazing sludge-treated pastures. The consequences of this are not known in terms of either animal health or human health, assuming humans consume the kidney tissue on a regular basis in animals that bioaccumulate trace metals in their organs.

The authors reported that "the possibility of PCB and other toxic organics reaching crop land is an issue of concern to farmers" and indicated that "more research is needed." They further noted that "caution should be exercised in using these data to predict health risks associated with sludges containing higher levels of disease agents and with higher sludge application rates and larger acreages treated per farm than used in this study" (Dorn et al. 1985). No similar subsequent studies have been conducted because the risks were deemed to be low and the costs for such studies are very high.

While the Ohio study does not present information that is completely applicable to the situation in California, it does represent the most thorough epidemiological study of biosolids land application in the United States. Its results, therefore, have been reported. Determinations of health

risks reported in this EIR are not based on the results of the Ohio study; rather, they are based on a review of available technical literature and the health risk assessments conducted by EPA to support the Part 503 regulations.